

Claims

1. Method of purifying a gas stream containing carbon dioxide and at least one impurity including hydrocarbons and nitrogen oxides, and possibly water, characterized in that it consists in:

5 A bringing the gas stream to be purified into contact with at least one adsorbent in aggregated form

➤ either comprising at least 70%, preferably at least 80% and advantageously at least 85%, by weight of zeolite LSX, at least 90%, preferably at least 95% and advantageously at least 98% of the exchangeable sites of which are occupied by sodium ions, the rest of the cations possibly being, for example, potassium cations, up to 5% by weight of a binder that is inert to the adsorption, and possibly up to 25%, preferably up to 20% and advantageously up to 15% of one or more other zeolites, such as zeolite X, zeolite A, etc. (type A aggregate);

➤ or comprising at least 70%, preferably at least 80% and advantageously at least 85%, by weight of a blend of at least 20% and preferably at least 30% of zeolite X and of at most 80%, preferably at least 70%, by weight of zeolite LSX, at least 90%, preferably at least 95% and advantageously at least 98% of the exchangeable sites of the said zeolites X and LSX of which are occupied by sodium ions, the rest of the cations possibly being, for example, potassium cations, up to 5% by weight of a binder that is inert to the adsorption, and possibly up to 25%, preferably up to 20% and advantageously up to 15% of one or more other zeolites, such as zeolite A, etc. (type B aggregate);

B- adsorbing at least some of the carbon dioxide, and at least some of the hydrocarbons and/or  $N_xO_y$  on the said adsorbent;

25 C- desorbing the impurities adsorbed on the said adsorbent; and

D- regenerating the adsorbent.

2. Method according to Claim 1 characterized in that a PSA, TSA, TPSA or TEPSA-type process is carried out.

3. Method according to Claim 1 or 2, characterized in that the adsorbent in the form of a type A aggregate is prepared using a preparation process comprising the following steps:

30 ① aggregation of the precursor product, i.e. the LSX-type zeolite initially in the powder state, with a binder that can convert to a zeolite;

② drying at low temperature (around 80-100°C) and calcination at a temperature between 300 and 700°C, preferably between 400 and 600°C, of the product obtained at ①;

③ zeolitization of the binder and simultaneous or consecutive, partial or complete, insertion into the zeolitic structure of  $\text{Na}^+$  ions instead of the already present exchangeable cations (especially  $\text{K}^+$ ) so as to have a final sodium exchange content of greater than or equal to 90%, preferably greater than or equal to 95% and advantageously greater than or equal to 98%;

④ washing of the product obtained at ③; and

⑤ drying and activation at a temperature between 300 and 700°C, preferably between 400 and 600°C, preferably in a stream of dry decarbonated air, advantageously in a continuously traversed bed, of the product obtained at ④.

4. Method according to Claim 1 or 2, characterized in that the adsorbent in type B aggregated form is prepared using a preparation process that comprises the following steps:

① aggregation of the precursor product, i.e. the blend of LSX-type and X-type zeolites initially in the powder state, with a binder that can convert to a zeolite;

② drying at low temperature (around 80-100°C) and calcination at a temperature between 300 and 700°C, preferably between 400 and 600°C, of the product obtained at ①;

③ zeolitization of the binder and simultaneous or consecutive, partial or complete, insertion into the zeolitic structure of  $\text{Na}^+$  ions instead of the already present exchangeable cations (especially  $\text{K}^+$ ) so as to have a final sodium exchange content of greater than or equal to 90%, preferably greater than or equal to 95% and advantageously greater than or equal to 98%;

④ washing of the product obtained at ③; and

⑤ drying and activation at a temperature between 300 and 700°C, preferably between 400 and 600°C, preferably in a stream of dry decarbonated air, advantageously in a continuously traversed bed, of the product obtained at ④,

and preferably prior to step ①, the X and/or LSX powders having undergone a sodium exchange, either before they are blended or just after they are blended.

5. Method according to any one of Claims 1 to 4, characterized in that the adsorbent in type A or B aggregated form is prepared using a preparation process comprising the direct aggregation of 95 parts by weight of zeolite LSX or an X/LSX

zeolite blend with at most 5 parts by weight of binder, followed by sodium exchange and activation.

5 6. Method according to any one of Claims 1 to 4, characterized in that the adsorbent in type A or B aggregated form is prepared by aggregating a binder that can convert to a zeolite, followed by zeolitization of the binder essentially into LSX zeolite and/or LSX and X zeolites and activation of the adsorbent.

7. Method according to any one of Claims 1 to 6, characterized in that the gas stream to be purified is based on air.

10 8. Method according to any one of Claims 1 to 6, characterized in that the gas stream to be purified is based on syngas.

9. Method according to any one of Claims 1 to 8, characterized in that the adsorbent bed is a multilayer system made up of several different superposed adsorbent beds and/or comprises at least one bed comprising a blend of several adsorbents.